

Advantages and Specific Paths for the Integrated Development of Scientific Journal Publishing in the 5G Era: Post-print

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Date: 2023-10-08T00:00:00+00:00

Abstract

Drawing upon 5G-related technologies and their current application status in news media and book publishing, this study identifies the advantages of convergent development for scientific journals in the 5G era and explores specific pathways for the integration of scientific journal publishing in the 5G context. In the 5G context, scientific journals benefit from more diversified communication media, more comprehensive content, richer communication forms, and more specific target audiences; the specific pathways for the convergent development of scientific journal publishing include: integrating VR/AR publishing; building new types of publishing education resource platforms; cultivating VR/AR content production talent, etc.

Full Text

Preamble

5G Era: Advantages and Specific Pathways for Integrated Development of Science and Technology Journal Publishing

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Abstract: Drawing on the current application of 5G-related technologies in news media and book publishing, this paper identifies the advantages of integrated development for science and technology journals in the 5G era and explores specific pathways for publishing integration under the 5G backdrop. In the 5G context, science and technology journals benefit from more diversified communication media, more comprehensive content, richer dissemination forms, and more targeted audiences. The specific pathways for integrated development include: integrating VR/AR publishing; building new educational

resource platforms for publishing; and cultivating talent for VR/AR content production.

Keywords: science and technology journals; 5G; integrated publishing; VR/AR

Classification Code: G230

Document Code: A

Article ID: 1671-0134(2021)11-066-05

DOI: 10.19483/j.cnki.11-4653/n.2021.11.020

Citation Format: Liu Xingxing, Zhao Wenqing, Sheng Jie, Zhao Junjie. Advantages and Specific Pathways for Integrated Development of Science and Technology Journal Publishing in the 5G Era [J]. *China Media Technology*, 2021(11): 66-70.

5G, or 5G technology, stands for the 5th Generation Mobile Networks or 5th Generation Wireless Systems. The year 2019 marked the “first year of 5G,” officially launching commercial 5G services for the public. Currently, 5G has achieved comprehensive commercialization, which can be understood as the deep integration of various industries with 5G technology. The “Proposal of the Central Committee of the Communist Party of China on Formulating the 14th Five-Year Plan for National Economic and Social Development and the Long-Range Objectives Through the Year 2035” explicitly states the need to “promote deep media integration, implement all-media communication projects, and strengthen new mainstream media.”

In the 5G era, everything is interconnected and everything can be a medium. Artificial intelligence (AI), facial recognition, holographic projection, augmented reality (AR), virtual reality (VR), and mixed reality (MR) have arrived as scheduled, bringing intelligence to the forefront. Presently, 5G has been preliminarily and widely applied across numerous industries, including autonomous driving, medical health, media, video, industrial manufacturing, and the internet. As a special publishing group and the primary platform for publishing scientific and technological achievements, science and technology journals constitute an important part of scientific research work and serve as a strategic front for scientific exchange and innovation breakthroughs [1]. Against the backdrop of commercialized 5G and its technological implementation, this will bring new growth momentum and development opportunities for the integrated development of science and technology journal publishing.

1. Current Application Status of 5G-Related Technologies in Publishing at Home and Abroad

For the book publishing industry, exploration of online channels has already begun on the fertile ground of short videos and live streaming, such as online marketing. VR reading has also “spread its wings,” with multiple publishing

units already applying this technology [2]. Regarding foreign newspapers and periodicals, *The Washington Post* utilizes artificial intelligence and big data to collect multimedia information, employing intelligent editorial departments and AI machines to retrieve and filter this information before synthesizing and outputting it as video, audio, and text news 稿件 [3]. Early “immersive” news reports launched by *The Guardian* in the UK, *The New York Times* in the US, and Vice.com have already taken critical first steps [4]. China’s most authoritative news media outlet, China Media Group, has adopted a strategic layout of “4K+5G+AI,” incorporating robot writing, high-definition live broadcasting, and robot live streaming [4]. The 2021 Spring Festival Gala first adopted 8K ultra-high-definition video and AI+VR naked-eye 3D studio technology. Some programs used AR technology to integrate natural landscapes into martial arts scenes, XR technology to illuminate starry skies, fireworks, and lights, and 3D snowflakes to transform the stage into a world of jade trees and pearl flowers. This is the magic of traditional media integrating new technologies in the 5G era, which is deeply impressive. Furthermore, AI technology in news media has already permeated every business process from collection to editing and dissemination, such as robot writing and virtual live streaming, with applications in domestic outlets like CCTV, Xinhua News Agency, and Southern Media Group, as well as foreign platforms like Forbes, AP, and Bloomberg. The combination of 5G technology with 4K, 8K, VR, and other ultra-high-definition videos has brought revolutionary changes to every aspect of news publishing, including collection, editing, broadcasting, and transmission.

For journal publishing, children’s science popularization journals such as *We Love Science*, *Little Copernicus*, and *Nature* currently use VR technology to display animals, plants, military equipment, and technological products, providing children with intuitive visual and auditory experiences [5]. Current research literature on the application of 5G in science and technology journal publishing includes the following: Wang Mei [6] studied the development status and integration of short video platforms for science and technology journals in the 5G era; Zhu Jingwei [7] pointed out that science and technology journals should pay attention to interdisciplinary scientific knowledge, correct the direction of scientific research, strengthen journal talent development, and innovate publishing mechanisms to gradually enable 5G technology to empower publishing activities and support content construction; Zhang Tianshu [8] proposed suggestions for science and technology journals to respond to the 5G era, including digital publishing transformation and process reengineering, actively promoting the construction of science and technology journal alliances, advancing scientific and technological system reform, and focusing on cultivating editorial personnel capabilities in the new technological era; Du Du et al. [9] noted that 5G applications will lead to the evolution of publications and promote upgrades in publishing models; Li Yazhuo [10] proposed innovative development of knowledge services for science and technology journals in the 5G era; Ma Qin [11] discussed the development transformation and strategic choices of the publishing industry in the 5G era; Liu Feng [12] outlined the innovation path for 5G

publishing: from knowledge dissemination intermediary to intelligent matching platform; Mao Wensi [2] offered several thoughts on the integrated development path of the publishing industry in the 5G era. Among these, Liu Feng primarily took a comprehensive perspective, while Mao Wensi focused mainly on book publishing, with neither addressing science and technology journal publishing specifically. As a specialized and niche traditional publication, how should science and technology journals develop while shouldering the important responsibility of transmitting scientific and technological information? What are the advantages of integrated development for science and technology journals in the 5G era? What are the specific pathways for their integrated development? This paper draws on relevant applications of 5G technology in news and book publishing to conduct preliminary theoretical exploration of integrated development in science and technology journal publishing, building a bridge between theory and practice.

2. Advantages of Integrated Publishing for Science and Technology Journals in the 5G Era

5G, with its brand-new network architecture, provides bandwidth exceeding 10 Gbit/s, millisecond-level latency, and ultra-high-density connections, achieving a new leap in network performance. Based on this, the advantages of integrated publishing for science and technology journals in the 5G era are mainly reflected in the following aspects.

2.1 Terminal Changes and More Diversified Communication Media

In the 5G era, terminal device forms will also change. In addition to smartphones from the 4G era, large-screen foldable smartphones, in-vehicle video terminals, and VR will become mainstream. The differences between smart TVs, tablets, and smartphones will become increasingly small, and multi-scenario ultra-high-definition video will bring science and technology journal audiences in the 5G era an even more ultimate audio-visual enjoyment, activating text reading. Moreover, smart terminal products (such as AR reading via QR codes) will emerge endlessly and, through network interconnection, form a true intelligent Internet of Things world, where constant connectivity will become the norm.

2.2 Content Form Changes and More Comprehensive Communication Content

From 1G to 4G, as media have upgraded, the forms of content published in science and technology journals have also changed. The 1G era featured traditional text; the 2G era added voice to text; the 3G era added images to voice and text; the 4G era added video and audio to images and text. Furthermore, the development of 4G and mobile internet promoted mobile reading [9]. The application of 5G in science and technology journal publishing will completely change the information form of the internet, with video becoming the “killer

application,” especially the saturation, color depth, color gamut, and depth of field displayed by 8K images. Currently, numerous science and technology journals are using WeChat public platforms and various online platforms to publish images and videos, which strongly proves that the video-ization of journal content will trigger widespread popularity and fierce competition. Due to 5G’s ability to support higher traffic and greater resolution, content such as 3D, VR, AR, 4K, 8K, and holography may become key layout directions for science and technology journal publishing.

From the perspective of the science and technology journal publishing ecosystem, the traditional paper-based journal content directly facing readers has become an industry weakness. *Trauma and Emergency Electronic Journal* has truly realized VR and AR technology in journal operation, achieving pioneering practice in the field of “VR/AR + Publishing Media”[13]. In the 5G era, the development of its technology will inevitably accelerate the fully immersive “reading” experience that relies on VR, AI, and other technologies, which may further break readers’ solidified thinking about traditional science and technology journals.

2.3 Richer Communication Forms

Currently, science and technology journals have weak channel influence and coverage, mainly due to insufficient content transformation capabilities and overly single communication channels. Initially, users obtained the latest scientific and technological information by reading paper-based periodicals. Later, multimedia forms emerged, including audio books, images, audio, video, and even integrated media. Particularly benefiting from 4G networks, the content dissemination of science and technology journals is transitioning from images and text to video. A large number of online video platforms have continuously emerged, from Tencent, Youku, and iQiyi to Xigua, Kuaisou, Huoshan, Douyin, and others. In the 5G era, the communication forms of science and technology journals will be further improved and developed based on 4G. Paper journals offer flat reading; electronic reading offers integrated media reading; VR/AR reading offers virtual immersive reading.

5G establishes closer and more complex connections between people and things, and user data in massive datasets is being endowed with increasingly greater commercial potential, including reading data, travel data, etc. When users “read” journals wearing VR devices, the VR device serves as a collector and recorder of physiological data, accurately measuring users’ reactions to science and technology journal content through body data such as heartbeat and brain-wave states [14]. This data will be used to build three-dimensional user models, thereby facilitating news and journal media and marketing organizations to provide personalized services and recommendations. Consequently, for the same journal, the content disseminated to different users will differ, as will the forms, achieving personalized 推送 for thousands of people and thousands of journals.

3. Specific Integration Pathways for Science and Technology Journal Publishing in the 5G Era

Each technological revolution is often accompanied by changes in production methods. Due to the continuous development of 5G, AI, VR, and other new technologies, the seamless integration of traditional science and technology journals with other industries is unstoppable, and content, application scenarios, and services will continuously iterate user needs. The continuous maturation and growth of 5G+ related technologies will force science and technology journal publishing integration toward continuous innovation and prosperity. Under this trend, science and technology journal publishing should integrate through new forms, with the main pathways as follows:

3.1 Create New Information Carriers and Introduce New Production Methods

3.1.1 VR/AR + Journal Publishing If the internet is the first generation of virtual interactive construction technology, then virtual reality is the second generation. VR publications can provide people with panoramic reading, bringing cross-temporal reading experiences and allowing readers to “dialogue” with authors and nature [15]. VR, or “Virtual Reality,” makes the virtual concrete, turning virtual into reality. VR/AR + journal publishing can enhance the dissemination of journal content, deeply excavate content, and create unique experiences.

The commercialization of 5G technology will greatly promote the development of VR/AR scenario-based reading methods, bringing users an immersive reading experience [4]. Among these, VR’s three-dimensional video, combined with 360-degree panoramic views and the integration of real scenes from the objective world, will allow users to gain a sense of deep participation and an unprecedentedly realistic and three-dimensional sensory experience. These technologies are also called “AR,” which uses virtual means to vividly display the real world before the audience. Early “immersive” news reports launched by *The Guardian* in the UK, *The New York Times* in the US, and Vice.com have already taken critical first steps [4]. *Aviation Knowledge* is a domestic science popularization journal that 较早 attempted to use VR technology for information dissemination, not only capable of disseminating popular science information in vivid and three-dimensional forms but also meeting users’ immersive experience needs and respecting their personalized information reception requirements [16]. With support from government special fiscal funds, China’s virtual reality producers are already numerous and have accumulated preliminary experience in the book publishing field [5]. Virtual reality producers create data using perception studios and other tools according to the service requirements of science and technology journals, then produce perception apps that support mainstream mobile terminals, PC terminals, and virtual reality software. After downloading the perception app released by science and technology journals, readers can use tablets, mobile phones, etc., as intermediaries to scan QR codes

on paper or digital journals to read multimedia information such as text, images, and video. Readers can also wear virtual reality hardware devices to interact with three-dimensional images [5].

The integration of VR publishing in China's science and technology journals urgently needs development, especially for science and engineering and medical journals, which can conduct diversified content structure processing of images, text, and video related to papers to achieve multi-dimensional expression, thereby enhancing the explanatory power and vitality of scientific and technological information resources [17] and strengthening user acceptance and stickiness. For various animal disease models required in different experiments in medical journals, these can be constructed in virtual scenes, and readers can intuitively understand the morphological changes of animal internal organs and tissues through virtual dissection. Readers can also complete animal modeling and repeat experiments through virtual methods. The emergence of VR technology has created new possibilities for the deep excavation of science and technology journal content, fundamentally enhancing readers' sense of experience, transcending media limitations, integrating with scenarios, and expanding application contexts.

In terms of journal publishing content, AR, VR, XR, MR, and other related technologies can provide digital content support for journal publishing. When journals publish content related to science and engineering, these technologies can provide more intuitive visual support for audiences (readers). Additionally, the O2O model of *Sports Illustrated* in the US can be referenced, where paper journals are published in two versions, with and without VR video, at different prices. Thus, online VR video content will also promote the sales of offline paper magazines, which in turn can direct users to online applications. Of course, related products for science and technology journal publishing need to be innovated, namely journal reading wearable devices, primarily wearable helmets supporting AR, VR, or MR, all of which support the digitization of journal publishing content.

3.1.2 AI-Guided Journal Content Creation and Editing From the upgrades from 1G to 4G, communication media and forms have undergone tremendous changes, but content has always been the core. The 5G era is no different. In the long run, the fundamental factor determining media value and development remains high-quality content. From the perspective of content production entities, the greater change in the 5G era should lie in AI empowerment. What is "AI"? AI is a cutting-edge technology that integrates deep learning or machine learning, computer vision, intelligent robots, natural language processing, real-time speech translation, and context-aware computing. This empowerment includes, on the one hand, robot editing and writing, and on the other hand, using special algorithms for personalized distribution of massive content. In the 5G era, the application of AI technology will help the publishing industry achieve seamless integration with the intelligent era [11]. AI will help tradi-

tional media accomplish “pushing the right content to the right people at the right time,” while internet new media also faces the upgrade and iteration of the “intelligent internet.”

The emergence of AI will substantially shorten editors’ working time in terms of computation, analysis, organization, and collection. Robots can help editors complete repetitive tasks such as summarizing, organizing, collecting, and filling, which will be the trend and may eventually replace manual labor. However, in the short term, machine writing capabilities still have certain defects, and fact verification still requires manual screening. The path to intelligent content production still needs the test of time. For journal content editing robots, they need to adopt visual analysis technology, natural language processing AI, and autonomous driving capabilities, and of course, must have 5G connectivity.

Introducing AI for deep learning or machine learning of large amounts of existing detection paper data means machines autonomously master learning capabilities, establish databases, and continuously update and improve them. Thus, 5G and AI can be used to conduct high-precision image recognition on newly submitted papers, especially images that are easily manipulated with Photoshop, helping editors make the first round of duplication screening. If the screening results show no issues, conclusions can be directly given; if there are doubts, secondary classification and screening can be conducted for professional editors to verify and confirm. This approach improves work efficiency on the one hand and reduces human omissions and misjudgment rates as well as the impact of subjective emotions on judgment on the other hand, compensating for editors’ shortcomings and strengthening and extending their perceptual and judgment capabilities.

3.2 Cross-Border Integration to Achieve Industrial Value-Added

The new intelligent interconnection system supported by 5G technology will penetrate all walks of life through expanded applications and integrate into all aspects of people’ s lives through various terminals [9]. 5G not only brings readers of science and technology journals multiple forms of experience but also provides multi-dimensional cross-border integration for science and technology journal publishing platforms. The integration of science and technology journal publishing in the 5G era is no longer limited to the “Internet +” of the 4G era but rather “5G+,” which emphasizes cross-border integration, such as with educational platforms, cultural platforms, live streaming platforms, and video platforms. Many publishing enterprises now cooperate with universities to produce VR course resources, such as the aerospace-featured VR courses by Harbin Institute of Technology Press and the ocean-featured VR courses by Qingdao Publishing Group [18]. Cross-border integration between publishing enterprises and educational platforms to build new service platforms will provide broader development paths for integrated publishing of science and technology journals.

Cross-border integrated publishing of science and technology journals should, on

the one hand, analyze their own resource characteristics, achieve data structuring and content productization, and on the other hand, change from passive to active, actively contacting other industries such as physical industries, empowering science and technology journal publishing resources to product terminals, and attempting the production and application of various intelligent products and terminals [9].

3.3 Solving Hardware and Software Challenges

5G accelerates the development process of all-media, and publishing units must cultivate a high-quality, high-level talent team adapted to integrated development, focusing on the cultivation of innovative and professional talents [2]. The communication content of science and technology journal publishing in the 5G era is innovating, new types of work are emerging, and editors themselves and their working methods also need to change. Editorial practitioners in the 5G context must possess both previous excellent professional skills and strengthen 5G-related technical professional skills training, including video production, etc. How should scene and sound switching be handled in video content? How are 360-degree scenes established in VR? How should content topic selection and planning be controlled? Furthermore, they need to continuously improve and innovate concepts and embrace new 5G technologies. They should actively utilize MOOCs for online learning of basic applications of new technologies and theories of AI based on the internet. Moreover, journal editorial offices with conditions can establish dedicated multimedia centers, recruit professional all-media editors, and lead all editors in learning basic professional knowledge of 5G technology.

In the 4G era, science and technology journals used “two micros and one terminal” (Weibo, WeChat public accounts, and App clients) to aid journal development. Currently, science and technology journal publishing should begin using the power of 5G to transform their genes, conduct genetic recombination and team rebuilding, accelerate deep integration with the market, and seek integration for future development to reconstruct the publishing ecosystem of science and technology journals.

3.4 Facing Challenges Rationally

The integration of 5G technology and science and technology journal publishing presents both opportunities and challenges. Currently, the commercial application of 5G is still in its initial industry stage, with some distance from large-scale promotion and application. Although “VR + Journal Publishing” makes journal content more three-dimensional, there are still many pain points and difficulties in actual implementation, such as how to keep users focused on the content itself rather than being attracted by technology. Additionally, due to the lack of mature business models, most publishing units still adopt a wait-and-see attitude. Although some applications in children’s science popularization books were mentioned above, they differ greatly from the booming film and television

content production. Moreover, the large-scale application of 5G-related technologies and the cultivation and introduction of related talents all require cost considerations and trade-offs.

Furthermore, the advancement of 5G technology will also bring related negative issues, and the resulting cybersecurity problems cannot be ignored. In the 5G era, as more AI enters, AI brings benefits but also threats, with interests and risks coexisting, such as the safe use of AI. There are also concerns about technological unemployment, the disappearance of low-level clerical work (repetitive labor), preventing addiction to “immersive reading,” and the excessive VR-ization of science and technology journal content [14].

The application of 5G is not yet mature and must be treated rationally, objectively, and fairly to reconstruct a healthy and benign future publishing industry ecosystem for science and technology journals. Of course, in the initial stage of 5G development, the most important thing is to stand at the height of the entire industry’s development, actively formulate relevant strategies, conduct integration of the science and technology journal publishing industry, and form effective alliance mechanisms. As the saying goes, “One must be strong to forge iron.” The development of core technologies, especially content production technologies, should be accelerated. “Broad observation leads to sound judgment; deep accumulation leads to thin 发.”

In the 5G era, integrated publishing of science and technology journals already possesses certain technical conditions and related advantages. Based on this, unified layout of AR/VR publishing content, AI-integrated publishing processes, and publishing forms integrated with science and technology journals is expected to form a new type of science and technology journal publishing media with certain influence and competitiveness. In the 5G era, the interactive integration of various intelligent new technologies will promote the integration and transformation development of the science and technology journal publishing industry chain.

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(Responsible Editor: Tu Dongmin)

Note: Figure translations are in progress. See original paper for figures.

Source: ChinaXiv – Machine translation. Verify with original.